NASA Technical Memorandum 81587

A QUANTITATIVE ANALYSIS OF INTER-ISLAND TELEPHONY TRAFFIC IN THE PACIFIC BASIN REGION (PBR)

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September 1980

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E-566

SUMMARY

As part of NASA's continuing assessment of future communication satellite requirements, a study was conducted to quantitatively scope current and future telecommunications traffic demand in the South Pacific Archipelagos. The area of interest encompasses both self-governing island chains and those that are possessions (excluding the state of Hawaii), protectorates, territories, and claims, either U.S. or foreign.

Indonesia, Malaysia, Singapore, Thailand, the Philippines, and Papua New Guinea have been excluded from this study because they are presently, or soon will be, served by the PALAPA communications satellite system. Only inter-island telephony traffic for the Pacific Basin Region (PBR) was included within the scope of the study.

Incomplete statistical traffic data for the PBR made it necessary to use analytical techniques to augment published data. Total number of telephones was used as an indicator of total telephony traffic and was applied as a correlation factor along with a traffic model in estimating the inter-island telephony traffic (call messages) for the PBR. The inter-island (toll) telephony traffic was expressed as total call-minutes, and converted to the total number of satellite transponders that would be required if all traffic were carried by satellite.

The total telephony traffic for the base year was estimated to be 1,843,000 inter-island (toll) calls per year. About one-third of a 36 MHz satellite transponder would be needed to satisfy the estimated base year traffic demand if the total demand were provided by satellite systems.

The total telephony traffic for the year 1985 was projected to be about 4,218,000 calls. In terms of satellite systems, this demand could be satisfied by about two-thirds of a 36 MHz satellite transponder.

INTRODUCTION

The application of market demand studies to determine the need and required capacity for future communications satellite systems is an important part of NASA's satellite communications program. NASA's chartered role, in fostering advanced space communications technology, requires a continuing assessment of potential markets and their economics to identify and develop the technologies required to enable implementation, by the private sector, of viable satellite telecommunications services. One area where the inherent wide area and distance insensitive coverage characteristics of satellite communication is especially attractive is in developing countries/regions with sparse population and large geographic areas. A prime example of one such region, where satellite-supplied domestic communication services appear appropriate, is the Pacific Basin Region (PBR).

The first step in the market assessment process is to quantitatively scope the current and future telecommunications traffic demand. The application of this first step to a preliminary study of the satellite communications market in the PBR is the subject of this report. The specific area of consideration is the South Pacific Archipelagos including both self-governing island chains and those that are possessions, protectorates, territories, and claims, either U.S. or foreign.

The purpose of this study is to estimate the inter-island telephony traffic for the PBR (excluding international telephony so as not to complete with those services already supplied by Intelsat), and then to determine the number of satellite transponders that would be required if all such traffic were carried by satellite.

The analysis set forth in this report defines the methodology needed to calculate the required telephony (voice) traffic statistics using the limited available data. The necessary steps in this methodology include: selection of the appropriate models and modeling techniques; the use of various criteria in the development of a predicting algorithm; and the utilization of the aforementioned in compensating for the scarcity of available data. This methodology is then used to estimate a base year (1976-1977) and near future (1985) demand for telephone (voice) service.

METHOD OF ANALYSIS

Scope of Effort

The area of interest encompasses the South Pacific Archipelagos including both self-governing island chains and those that are possessions (excluding the state of Hawaii), protectorates, territories, and claims, either U.S. or foreign. See figure 1, a map of the Pacific Basin Region (PBR), for identification and location of the areas of interest (ref. 1).

The island of Guam, with special consideration of its military base and personnel, is also included within the scope of this study.

Indonesia, Malaysia, Singapore, Thailand, the Phillippines, and Papua New Guinea have been excluded from this study because they are presently, or soon will be, served by the PALAPA communications satellite system. (Private communication from C. R. Jones, Hughes Aircraft Company; Space and Communications Group, Los Angeles, California.)

The satellite service of interest is voice communication for regional routes such as small-island to small-island (inter-island) traffic. Because voice services dominate the current and near future telecommunications demand (ref. 2), only telephone service requirements were considered. International telephony has been excluded since such services are presently being supplied by Intelsat (ref. 3).

The quantification of this traffic ideally requires a detailed knowledge of the total message traffic and its distribution. Where this traffic data is not available, it may be estimated from a knowledge of the total number of telephones in service for the area of interest (i.e., PBR), the number of regional calls per telephone, and the average time duration of each call.

Methodology

As a first step in this study, a data base for the PBR was assembled in order to determine if the telephony requirement could be calculated directly from available data. The data base acquired contained telecommunication statistics as well as demographic data including population, annual population growth rate, gross domestic product (GDP), and GDP density. Although much statistical data makes use of the Gross National Product (GNP) as an economic indicator, the plurality of reference sources used in this study use the Gross Domestic Product (GDP) as a correlation parameter. The definitions and the basic difference between the GDP and the GNP are given in appendix A.

As discussed previously, if the inter-island call data were readily available for the PBR, a direct calculation could be made to determine the number of satellite transponders required to accommodate the traffic demand (i.e., both 1-way and 2-way circuits). This could be accomplished by converting the call data to call-minutes and then relating this to the capacity of the standard 36 MHz transponder.

Unfortunately, after searching through numerous data references, it was found that documented call data for the PBR were not available. This lack of tabulated data made it necessary to employ analytical techniques to formulate an estimated call-statistic data base for use in the capacity determination. It was decided that the most promising method of estimating the call-statistics for the PBR would be to first examine the telephony traffic characteristics of similar island-chain communities, and then apply comparison modeling methods to relate those characteristics to the PBR. After a search of potential island-chain models, it was decided to use the Hawaiian islands as a traffic model employing call-statistics obtained from the Hawaiian Telephone Company, because the data were available.

In order to use the island-chain model (i.e., the Hawaiian Telephone Company) as a traffic model for the PBR, the available demographic and telecommunications data were analyzed and examined for those parameters which showed a dependence or relationship between the telephony characteristics of the traffic model (i.e., the Hawaiian Telephone Company) and the area of interest (i.e., PBR).

There are a number of parameters that can be used to relate the telephony characteristics of the traffic model to the PBR, such as the number of telephone sets, radio sets, population (size and distribution), GDP, GDP per capita, and GDP per square kilometer (refs. 4 and 5).

Intuitively, it appears that the number of telephones is a first-order correlator to the amount of inter-island (toll) telephone traffic and, therefore, it was the first parameter examined and thoroughly investigated. To make a first-order approximation of the inter-island telephone traffic, it was assumed that a direct linear relationship between the number of telephones and the volume of inter-island telephone traffic existed. A simple estimate of the number of telephone calls could then be made by taking the ratio of the number of telephones to the number of telephone calls in the traffic model, and equating this to the ratio of the number of telephones to the number of telephone calls in the subject countries of the PBR.

Table 1 displays the telecommunications statistics for the PBR such as the total number of telephone sets, telephone density, total number of radio sets, and radio density (refs. 6 to 9). The voids in table 1 indicate the dearth of available data for the PBR. In particular, data on the number of telephone sets in use within the PBR are incomplete.

In order to compensate for the missing telephone set data and to complete the data base, an estimating technique was devised and subsequently used to determine the missing entries in table 1. Four basic techniques or methods were considered (ref. 10): (1) Trend Method (this method is best suited to a country with a well-established telecommunications system, one in which the history of demand is established); (2) Comparison Method (the estimated telephone growth is patterned after trend data from a model country in a similar state of development); (3) Population Method (in situations lacking statistics other than population, this method is used to relate the number of telephone sets to population); and (4) Economical/Mathematical Method (this method is primarily used for short term planning and makes use of trend data in relationship to linear, quadratic and exponential growth approximations).

The comparison method was chosen for this study because it was most adaptable to the available PBR data base. This method is based upon using available key telecommunication and demographic parameters to select a "model" country for each of the "subject" PBR countries. A "model" country, with available telephony data, was selected in the following manner. For those PBR countries lacking a suitable telephone data base, another primary indicator of telecommuncations traffic and hence, a usable comparative statistic is radio density (i.e., the number of radios per 100 population). The radio density of the "model" country was compared and matched to the radio density of the "subject" country. This correlation of "model" and "subject" countries was further refined by comparing the population growth rate, which serves as an indicator of the overall growth in the economy and the use of telecommuncations. In situations where two or more countries emerged as "model" candidates, or when the population growth rate was negative or unavailable, the GDP per capita was used in the comparison analysis. Trend data from these selected "model" countries were then used to fill voids in the PBR data base.

Based upon the above rationale, the following approach was used to estimate the satellite capacity required to meet the current and near future (1985) voice telephony demands in the PBR,

(1) Select the model countries for use in the comparison method.

(2) Use the comparison method to estimate the missing telephone set data for the PBR.

(3) Using the Hawaiian Islands traffic as a model and the total number of telephone sets as a correlation factor, estimate the inter-island telephony traffic for the PBR.

(4) Using the inter-island telephony traffic estimate, calculate the number of satellite transponders required to meet the base year (1976-1977) demand.

(5) Estimate the near future (1985) transponder requirements by using projected telephone growth as a forecasting indicator.

RESULTS AND DISCUSSION

PBR Telephones in Base Year

Having determined that the available telephone data for the PBR were inadequate, the procedures defined in the previous section were employed to estimate the missing information.

First, to select the model countries to be used in the comparison method, the countries of South America were chosen as a set of potential models.

South America is a large geographical area with many similarities to the PBR. In both South America and the PBR, there are vast regions where the terrain or topography are not easily accessible to terrestrial telecommunications facilities. Both regions have population centers which are widely scattered and the development of conventional terrestrial communications facilities has been very limited (ref. 11).

Thus, South America is an area where satellite communication is particularly applicable just as it is in the PBR. In fact, a study performed by a number of Canadian market assessment firms (sponsored by the Canadian government) concluded that a regional satellite system would be desirable for the South American countries (ref. 12).

Table 2 shows a number of pertinent demographic and telecommunications data for the South American candidates (refs. 6 to 9). These data were used in estimating the number of telephone sets in those PBR subjects where this information was lacking. The five island chains in the PBR for which telephone data were unavailable were the Pacific Islands, Cook Islands, Gilbert Islands, New Hebrides, and Niue Island. The comparison technique was employed to provide the missing telephone data and the primary parameter used in the comparative analysis was the radio density. The population growth rate was used as a secondary comparison parameter for refinement. The above data were available for virtually all subject and model countries. In some cases, GDP per capita was also used to compare subject and model countries especially if the growth rate was not available or considered not applicable (i.e., negative). Table 3 is a listing of the five PBR islands (subjects) with missing telephone data together with their potential South American model countries.

Uruguay was selected as the model for the Pacific Islands. This choice was based on similar radio densities and the GDP per capita of the subject and the model (see tables 1 and 2). Population growth rate data were not available for Uruguay and could not be used in the comparison.

When considering the Gilbert Islands (now known as Kiribati), both Columbia and Peru emerged as candidate models. The radio density and population growth rates for these two candidate models were similar. To help discriminate between the two, the GDP per capita criterion was also applied. Columbia was selected as the "best" model.

When examining the Cook Islands and comparing the radio density, population growth rate, and GDP per capita with those values given in table 2 (i.e., South American models), Suriname emerged as the best model.

Although Brazil has an almost identical radio density and population growth rate as the New Hebrides, its population is very large compared to the New Hebrides. Also, economic development is much greater as indicated by the GDP per capita. Peru, with a much smaller population, similar radio density and an equivalent GDP per capita was chosen as the best model for the New Hebrides.

Inspection of the appropriate entires in tables 1 and 2 shows that not only do Chile and Niue have very similar radio densities, but they also have identical population growth rates. However, Chile was rejected as a model because of its comparatively large population. Similarly, Brazil and Peru were rejected because of their comparatively large populations. Suriname, with its relatively small population and comparable radio density, was chosen as the best South American model country for the isle of Niue.

The second step in the methodology is to use the selected model countries to estimate the missing telephone set data for the PBR. The population ratio (i.e., Rp = population of the subject country divided by the population of the model country) was determined and used to estimate the number of telephones in the subject PBR countries with missing data. The population ratios for each subject-model pair are listed in table 4.

The estimate of the number of telephones for the subject in the PBR countries with missing telephone data was accomplished by performing the following calculation for the base year (1976-1977).

$$N_{Subject} = N_{Model} \times R_P$$

where N_{Model} is the total number of telephones in the model country; and $N_{Subject}$ is the calculated estimate for the total number of telephones in the subject country. The GDP per capita ratio was originally considered as a factor in the telephone estimating calculation to account for differences in the relative states of economic development in the subject and model countries. It has been shown that there is a dependency between the development of telecommunications services, as reflected in the number of telephones per capita and the state of economic development of a country (ref. 11). However, in this study, the net effect of including the GDP per capita, only produced a small percentage change (less than 3%) in the results. It was, therefore, not included in the final calculations.

A listing of the total number of telephones for the PBR islands in the base year (1976-1977) is shown in table 5 including those determined by census as well as those estimated as described above. The total number of telephone sets rounded to the nearest thousand (i.e., 144,000) in the PBR in the base year was used to calculate the total inter-island telephony traffic using the Hawaiian Telephone Company traffic model.

Inter-Island Telephony (Calls) in Base Year

In order to use the Hawaiian traffic model in translating the total telephone estimate for the PBR into an estimate of the number of inter-island telephone calls, the germane telephone statistics for the state of Hawaii, the city of Honolulu, and the remainder of the state of Hawaii excluding the city of Honolulu (i.e., Hawaii minus Honolulu) were assembled. These data are for the base year (1976-1977) and are displayed in table 6.

Since all inter-island calls are toll calls, the number of inter-island calls is equal to the number of toll calls minus the number of interstate calls. (Private communication from Richard Hiza, General Manager, Hawaiian Telephone Company, Honolulu, Hawaii.) (See Table 7).

Because the telephone density for the city of Honolulu is extremely high (i.e., 92 telephones per 100 population) compared to the PBR, a further segmentation of the data was performed in order to make the Hawaiian Telephone Company data a more representative traffic model for the PBR. The model was partitioned into a high telephone density area and a medium telephone density area more characteristic of what would be expected in the PBR.

Once the Honolulu telephone data were removed from the state of Hawaii totals, the telephone density (i.e., approx. 55.5 per 100 population) for the modified traffic model was more consistent with the expected PBR density. The ratio of the number of medium density telephones to the total number of telephones in the entire state of Hawaii was then used to normal-

ize the telephone traffic statistics. This ratio is: 282,000/630,000 = 0.4476. Multiplying this ratio by the total number of inter-island (toll) calls (7,956,000) yields 3,561,000 calls. This is the number of inter-island calls made during the base year (1976-1977) in the medium density traffic model (i.e., partitioned Hawaiian Telephone Company data).

From table 5, the rounded combined total of telephones (census plus calculated estimates) in the PBR is 144,000 sets. By taking the ratio of the total number of telephones in the PBR to the number of medium density phones in the traffic model (282,000) and multiplying by the number of annual inter-island calls in the medium density traffic model (3,561,000), the result is the estimated number of annual PBR inter-island call messages or 1,818,000 calls.

Inter-Island Telephony (Transponders) in Base Year

The estimated inter-island (toll) telephony traffic can then be converted to a satellite transponder requirement by first computing total call-minutes. This is done by assuming that the average toll call is 9 minutes in duration (refs. 4 and 5).

The total number of predicted call-minutes per year is then 9 minutes x 1,818,000 calls per year, or 16,362,000 call-minutes per year. By assuming that this total annual traffic is distributed over 2,400 busy hours during the year with the trunk distribution and grade of service being such that the ratio of Erlangs to circuits is 0.8 (refs. 4 and 5), it then requires 0.28 standard 36 MHz satellite transponders to service (i.e., accommodate) all of the PBR inter-island telephony traffic in the base year (1976-1977).

Inter-Island Telephony (Transponders) in 1985

Figure 2 is a plot of the total number of telephones versus year for several representative island chains for which data was available for the years 1970 to 1976. This representative sampling of data was used to estimate a composite average annual growth rate for the PBR. The average annual growth rate for each island is shown in figure 2 along with the composite of these averages. This composite was used as an estimate of the near-term average annual growth rate for telephones in the PBR.

By applying this composite average annual growth rate to the estimated number of PBR telephones in the base year (1976-1977), the total number of telephones in service in the PBR by 1985 is estimated to be 334,000. By the same technique described in the previous sections, this telephone requirement can then be converted to a 1985 satellite requirement of 0.66 transponders.

Possible Impact of Data and Video Services

If data and video telecommunications demands were added to the voice telephony traffic, the transponder requirements would obviously be increased. By including data transmission as an additional demand, it is estimated that the overall transponder demand would be increased by approximately 20% (ref. 2).

Of greater significance would be the addition of video services. Any estimate of the effect of these services (i.e., cable television, television broadcasting, and videoconferencing) on the transponder requirement must reflect the broad frequency bandwidths that are necessary to deliver video offerings. Although the demand for such services is difficult to project, consideration of the multilingual and varied cultural characteristics of the PBR suggest that the use of several transponders for video services should be expected.

SUMMARY OF RESULTS

This study has estimated the total inter-island telephony traffic (messages) for the Pacific Basin Region. International telephony (i.e., those services which are supplied by Intelsat) has been excluded. Indonesia, Malaysia, Singapore, Thailand, the Philippines, and Papua New Guinea have been excluded from this study because they are presently, or soon will be, served by the PALAPA communications satellite system.

The total number of telephones in service within the PBR for the base year (1976-1977) was estimated to be 144,000. The number of telephones per 100 population was about 8. The total telephony traffic for the base year (1976-1977) (i.e., total number of messages) was estimated to be 1,818,000 inter-island, non-international calls per year and approximately 16.36 million call-minutes per year.

Approximately one-third of a 36 MHz satellite transponder would be needed to satisfy the estimated base year traffic demand if the total demand was satisfied by satellite systems.

The total number of telephones in service within the PBR by the year 1985 is estimated to be 334,000. Using a composite average annual population growth rate for the PBR, the number of telephones per 100 population is estimated to be about 15 by 1985. The total telephony traffic by 1985 is estimated to be about 2.3 times that of the base year, or 4,218,000 calls. In terms of satellite capacity, this demand would require about two-thirds of a 36 MHz satellite transponder. It is estimated that the addition of data traffic could increase the transponder requirements by about 20 percent while the addition of video traffic could add several transponders.

APPENDIX A

The Gross National Product (GNP) consists of the total market value of goods (including the value of inventory changes, but excluding all intermediate goods consumed by business) and services purchased by public (government), private (individuals and businesses), and non-profit institutions, and the net exports (exports minus imports) of goods and services.

The Gross Domestic Product (GDP) is the total market value of domestic expenditures on the final uses of the domestic supply of goods and services including public (government), private (individuals and businesses), and non-profit organizations, less the imports of goods and services.

In summary, the basic difference between GNP and GDP is that the export value is not a component part of the GDP, whereas it is a component of the GNP.

In most countries the export value of goods and services is a very small percentage of the total GNP. The oil exporting nations of the world are a notable exception. Use of the GDP, in lieu of the GNP, is a legitimate and objective parameter upon which to base calculations and predictions of the future capacities or quantities of a particular vital demographic statistical datum (refs. 7 and 13).

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TABLE 1

PACIFIC BASIN DEMOGRAPHIC DATA (1976-1977)

ISLAND GROUP	POPULATION (MID-YEAR) 1977	% ANNUAL POPULATION INCREASE (1970-1977)	GDP (MILLIONS OF 1976 U.S. DOLLARS)	GDP PER CAP.	TELEPHONES (THOUSANDS)	TELEPHONES PER 100 POP.	RADIO SETS (THOUSANDS)	RADIO SETS PER 100 POP.
Fiji Islands	596,000	2.0	772	1287	33	5.5	300	51.7
Solomon Islands	207,000	3.5	62	326	1.984	1.0	11	5.5
Samoa (Western)	153,000	1.0	62	411	3	2.2	50	32.9
French Polynesia	136,000	3.3	578	4444	17	12.9	70	56.5
New Caledonia	136,000	2.8	834	6413	23	17.0	60	44.4
Pacific Islands	126,000	4.2	212	1500			72	63.2
Tonga	91,000	0.6	37	371	1.285	1.4	15	16.7
New Hebrides	99,000	2.7	70	670			15	15.5
Guam	104,000	2.8			39	32	87	85.3
Gilbert Islands	70,000	3.1					8.2	12.
American Samoa	34,000	2.6			4	13.8	4.2	13.4
Cook Islands	18,000	-1.8	16	796			7	28.3
Wallis & Futuna Is.	9,000				.148	1.6		
Nauru	8,000	1.9			1.5	20.8	3.6	45.0
Niue	6,000	1.9					0.8	20.5
Midway Island	2,000				.648	129.6		
Norfolk Island	2,000	4.1			.4	22.2	1.2	63.9
Wake Island	2,000				.121	60.5		
Tokelau	2,000							
Johnston Island	1,000							

Sources
Population and telephone data: Refs. 6,7,8,9.
Telephone per 100 population: Ref. 9.

TABLE 2

SOUTH AMERICAN DEMOGRAPHIC DATA (1977)

COUNTRY	POPULATION (MID 1977) (THOUSANDS)	% ANNUAL POPULATION INCREASE (1970-1977)	GDP (MILLIONS OF 1976 U.S. DOLLARS)	GDP PER CAP.	TELEPHONES (THOUSANDS)	TELEPHONES PER 100 POP.	RADIO SETS (THOUSANDS)	RADIO SETS PER 100 POP.
Brazil	112,239	2.8	166,344	1482	4836	4.1	16,980	15.8
Argentina	26,056	1.3	49,088	1934	2342	9.0	21,000	83.8
Chile	10,656	1.9	9,221	865	467	4.8	1,800	17.2
Columbia	25,048	2.9	13,574	568	1396	5.6	2,850	11.7
Peru	16,358	2.9	10,572	646	403	2.6	2,068	12.9
Venezuela	12,737	3.1	35,592	2794	742	6.0	5,034	40.7
Ecuador	7,556	3.4	6,152	814	221.5	2.9	1,700	27.9
Bolivia	5,950	2.7	2,508	445	101.5	2.1	430	7.4
Uruguay	2,846	N/A	3,693	1319	268	9.5	1,609	51.6
Paraguay	2,805*	2.9	2,092	745	40	1.4	80	6.6
Guyana	827	2.4	438	562	23	2.8	275	[illegible]
Suriname	448	2.7	503	1194	19	4.2	112	25.7
French Guyana	60	N/A	N/A	N/A	11	18.3	2.9	4.8
Falkland Island	2	N/A	N/A	N/A	.526	29.2	1.1	54.6

N/A = Not Available

* = persons aged 11 and over

Sources
Population and telephone data: Refs. 6,7,8,9.
Telephones per 100 population: Ref. 9.

TABLE 3

	PACIFIC BASIN REGION		SOUTH AMERICA
SUBJECT	RADIO DENSITY (PER 100 POP.)	POPULATION GROWTH RATE (%/YR.)	MODEL
The Pacific Islands	63.2	4.2	Uruguay*
Gilbert Islands	12.1	3.1	Columbia* Peru
Cook Islands	28.0	-1.8	Suriname* Guyana
New Hebrides	15.5	2.7	Peru* Brazil
Niue	20.0	1.9	Chile Brazil Suriname* Peru

*Selected as "best" model

TABLE 4

(PBR) SUBJECT	(S/A) MODEL	POPULATION RATIO (R_p)
Pacific Islands	Uruguay	0.0443
Gilbert Islands	Columbia	0.0028
Cook Islands	Suriname	0.0402
New Hebrides	Peru	0.0060
Niue	Suriname	0.0134

TABLE 5

PBR TELEPHONES IN 1977

PBR ISLAND(S)	NUMBER OF TELEPHONES
Pacific Islands	(11,872)
Gilbert Islands	(3,909)
Cook Islands	(764)
New Hebrides	(2,418)
Niue	(255)
Fiji Islands	33,000
French Polynesia	17,000
Guam	39,000
Midway Island	648
Nauru	1,500
New Caledonia	23,000
Norfolk Island	400
Samoa American	4,000
Samoa Western	3,000
Solomon Islands	1,984
Tokelau	No Telephones
Tonga	1,285
Wake Island	121
Combined (census + calculated estimates)	144,156

NOTE: Numbers in parentheses are calculated estimates

TABLE 6

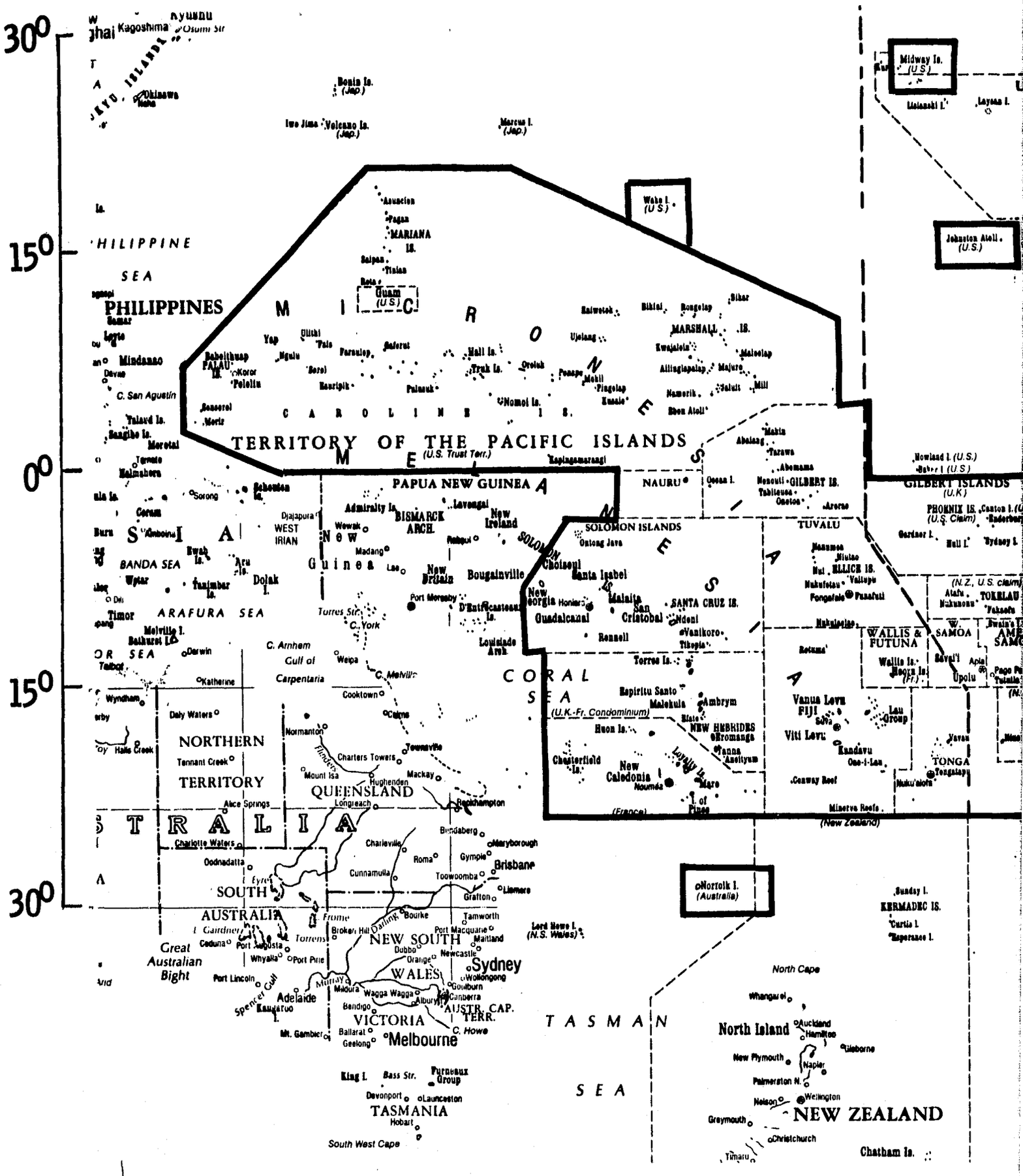
HAWAIIAN TELEPHONE COMPANY DATA

	(1976) Population	Annual Population Growth Rate (1976-1979)	Number of Telephones (1976-1977)	Telephones Per 100 Population (1976-1977)
State of Hawaii	887,000	1.58%	630,021	69.92
City of Honolulu	378,000	2.72%	347,806	92.00
State of Hawaii minus City of Honolulu	509,000	0.76%	282,215	55.44

TABLE 7

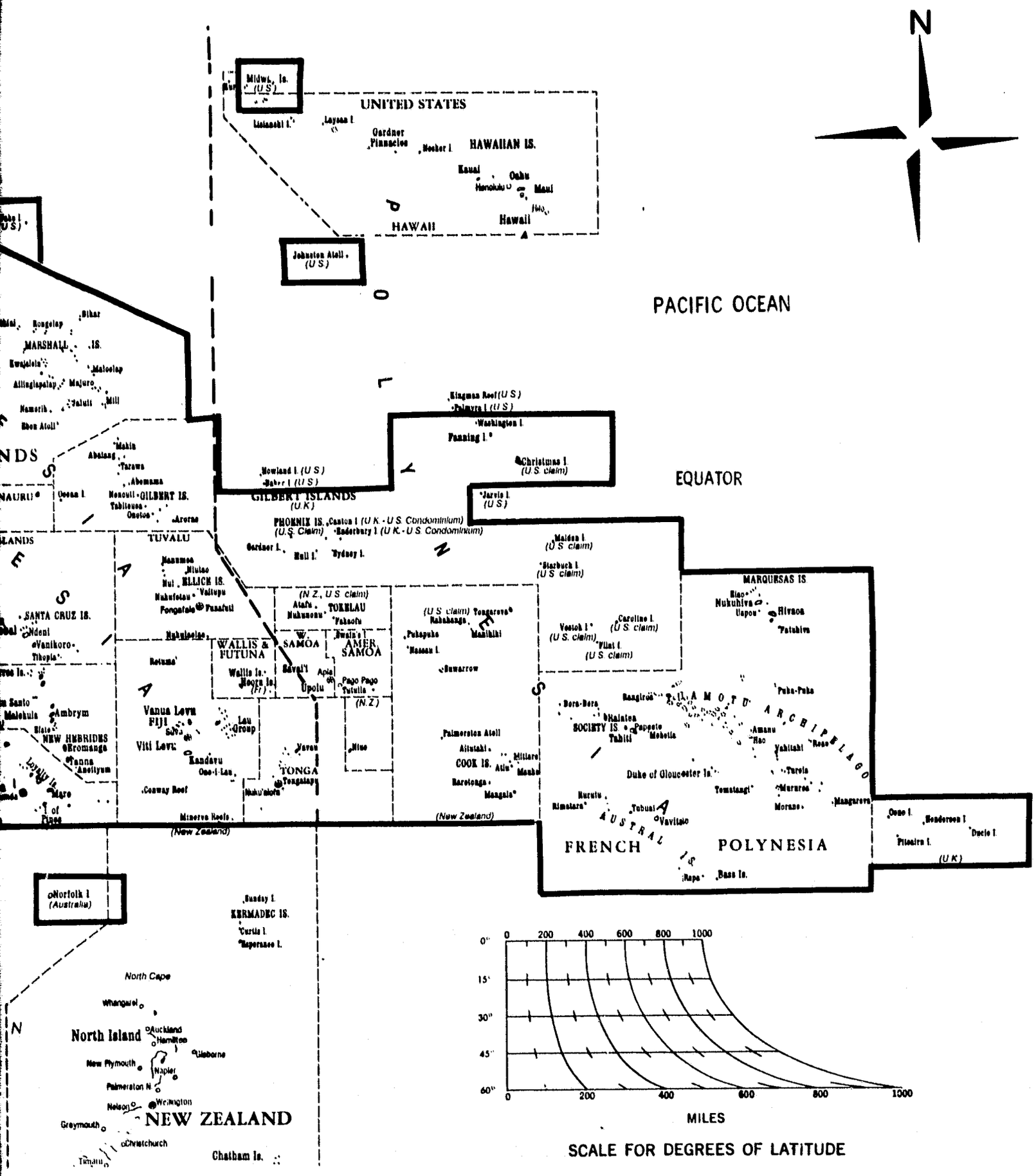
HAWAIIAN TELEPHONE COMPANY TELEPHONY STATISTICS (1979)

TYPE OF CALL	NUMBER OF CALLS
Local	1,453,845,000
Toll	30,956,000
Interstate	23,000,000
Inter-Island (toll)	7,956,000



FOLDOUT FRAME

Figure 1. - Map of the Pacific Basin region (ar



e Pacific Basin region (area within heavy lines).

FOLDOUT FRAME

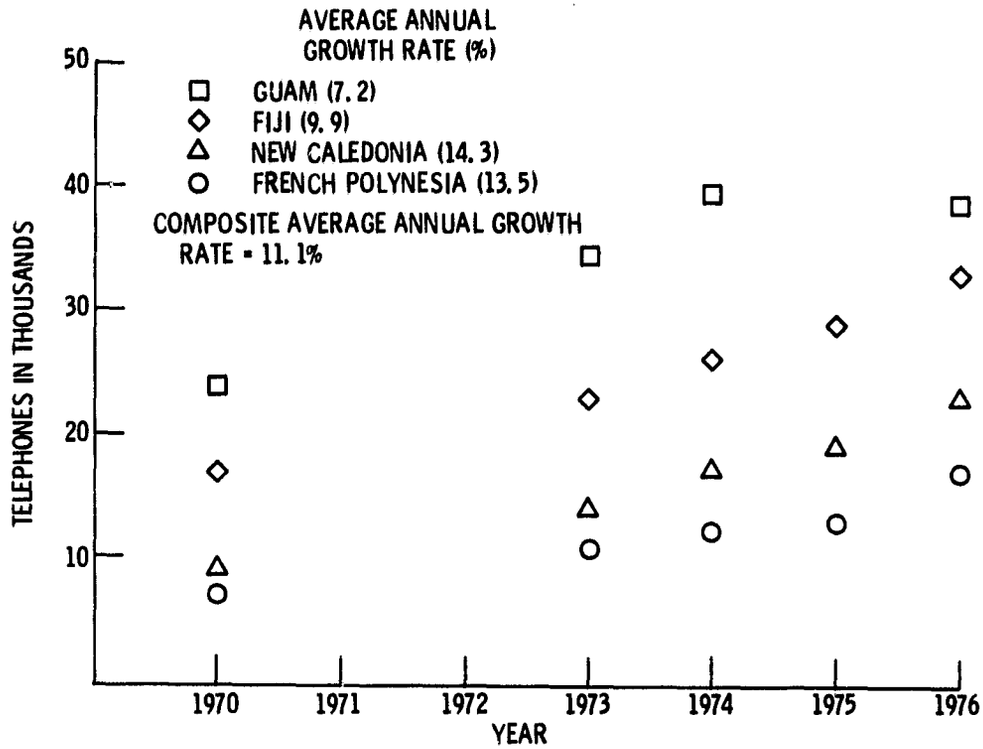


Figure 2. - Growth of telephones in service.